Currency Exposure in China under the New Exchange Rate Regime: National Level Evidence

Jing Nie, Zhichao Zhang, Zhuang Zhang, Si Zhou*

Abstract

The present paper studies China's national level currency exposure since 2005 when the country adopted a new exchange rate regime allowing the renminbi (RMB) to move towards greater flexibility. Using generalized autoregressive conditional heteroskedastic and constant conditional correlation-generalized autoregressive conditional heteroskedastic methods to estimate the augmented capital asset pricing models with orthogonalized stock returns, we find that China equity indexes are significantly exposed to exchange rate movements. In a static setting, there is strong sensitivity of stock returns to movements of China's trade-weighted exchange rate, and to the bilateral exchange rates except the RMB/dollar rate. However, in a dynamic framework, exposure to all the bilateral currency pairs under examination is significant. The results indicate that under the new exchange rate regime, China's gradualist approach to moving towards greater exchange rate flexibility has managed to keep exposure to a moderate level. However, we find evidence that in a dynamic setting, the exposure of the RMB to the dollar and other major currencies is significant. For China, the challenge of managing currency risk exposure is looming greater.

Key words: capital asset pricing models; exchange rate regime; currency exposure; generalized autoregressive conditional heteroskedastic modeling

JEL codes: G3, F4, E3

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I. Introduction

Exchange rate fluctuation has been an enduring feature of the world economy since the collapse of the Bretton Woods system in the 1970s. Currency variability heightens the uncertainty of the economic environment and affects firms' performance. Therefore, it represents a key risk factor for the national economy. For China, such currency risk was implicit when the renminbi (RMB) was pegged to the US dollar. However, with the development of exchange rate reform leading to the RMB's gradual move towards greater flexibility, exposure to currency risk has increasingly become a problem with growing significance.

After more than a decade of pegging the RMB to the dollar, on 21 July 2005 the Chinese Government announced the lifting of the dollar peg to allow the RMB to float under management. Since then, the Chinese currency has shown an increased tendency of flexibility in its movement. The regime shift places Chinese firms and the national economy under increasing exposure to currency risk. In this light, this research is motivated to assess the extent to which China is exposed to currency risk under the new exchange rate regime. To gain national-level evidence and given the data availability, our investigation focuses on responses of the Chinese stock market to RMB exchange rate changes.

Prior studies on exchange rate exposure are more concentrated at the firm or industry level. Studies of currency exposure usually follow the standard approach pioneered by Adler and Dumas (1984), which is to measure the correlation of exchange rates and the firms' market value (see e.g. Aggarwal, 1981; Soenen and Hennigar, 1988). Jorion (1990) analyzes the exposure of 287 US multinationals and find that 15 firms were significantly affected by exchange rate changes. Bodnar and Gentry (1993) find that 21 and 35 percent of Canadian and Japanese industries, respectively, have statistically significant currency exposure. Results of other studies are similar (Dickey and Fuller, 1981; Jorion, 1990; He and Ng, 1998; Dominguez and Tesar, 2001; Koutmos and Martin, 2003). Rees and Unni (2005) find that 87 percent of UK firms have significant exposure to the euro, while 23 percent of firms in Germany and 27 percent in France have significant exposure. In Asia, according to Muller and Verschoor (2007), 30 percent of Thai multinationals and 20.5 percent of multinationals in Singapore have significant exposure to the US dollar, while 20 percent of Hong Kong firms and 27 percent of firms in Indonesia have significant exposure to the Japanese yen. The literature has advanced a range of reasons for the phenomenon of the varying degree of exposure, including time-varying risks (De Santis and Gerard, 1998), hedging activity (Allayannis and Ofek, 2001), neglecting competitiveness within industrial sectors (Marston, 2001) and asymmetric exposure (Koutmos and Martin, 2003).

While the firm-level research can shed light on individual firms' sensitivity to exchange rate changes, the present research considers exposure at the national level. Using a series of generalized autoregressive conditional heteroskedastic (GARCH) models, we estimate to what extent currency exposure exists in China. Prior studies have commonly adopted the augmented capital asset pricing models (CAPM) model to measure the residual exposure. However, following this approach, interactions may be omitted between the changing exchange rate and stock values, leading to insignificant results. The present study uses orthogonalized market returns to represent components of market returns that are uncorrelated with exchange rates.

To estimate currency exposure in the changing environment that the Chinese economy is faced with, we utilize the GARCH (1, 1) specification, along with the constant conditional correlation (CCC) model. Bollerslev (1990) extends the GARCH model to include a CCC factor, thus obtaining the full covariance matrix, rather than just the single variances as in the standard GARCH structure. Such models use the conditional variances and correlations instead of straightforward modeling of the conditional covariance matrix, hence benefiting from the intuitive interpretation of correlations.

Our research finds a significant correlation between the Chinese stock market and the RMB exchange rate movements. The results suggest strong sensitivity at the national level of Chinese firm values to China's trade-weighted exchange rate, and to some bilateral exchange rates. In a dynamic setting, exposure to all the bilateral exchange rates under examination is significant.

The rest of the paper is organized as follows. Section II presents a review of the literature related to the theoretical foundation and empirical application of national-level currency exposure. Section III discusses the econometric formulations and the data collection process. Empirical results and their analysis are reported in Section IV. Section V presents conclusions.

II. Related Literature

While the focus of previous studies is on identifying exchange rate exposure at the firm and industry levels, recently there has emerged interest in investigating exposure at the national level. Entorf *et al*. (2011) show that the national approach allows consideration of the aggregation of interplays between firm value and the changing exchange rate in a macroeconomic setting. The ensuing framework underpins the wider issues involved in currency risk exposure through capturing the influences of macro factors that have an influence on both the stock market and the exchange rate. As such, it provides a new perspective for understanding the degree of currency risk that the national economy is exposed to. In addition, studies of national-level exposure have the advantage of mitigating the missing variable problem in regression analysis, because of better availability of macro data relative to firm-level data, such as breakdown of costs and profits. In a study using daily data from 24 countries for April 1988 to March 1991, Roll (1992) finds a positive relation between the stock and foreign exchange markets. Conversely, using monthly data for 1977–1989, Chow *et al*. (1997) find no significant relation between monthly excess stock and exchange rate returns. Using monthly data on 10 industrialized countries between January 1973 and August 1996, Friberg and Nydahl (1999) explore the linkage between currency exposure and openness of the national economy. The evidence they unearth shows that the more open the economy is, the stronger the positive relation between stock returns and exchange rate fluctuation. Narayan (2009) investigates currency exposure in a dynamic setting in Mexico, Malaysia, Thailand, Brazil and Argentina. Using daily data of stock indexes and the dollar exchange rate during 1994 to 2003, they find unidirectional causation running from stock prices to exchange rates in Mexico, Argentina and Brazil, but running from exchange rates to stock prices in Malaysia and Thailand. Entorf and Jamin (2007) estimate a time-varying measure of overall German currency risk and propose that it depends significantly on both German exports and imports. Using data from 28 German DAX companies, they confirm that the German mark/US dollar rate is positively affected by the ratio of exports to GDP and negatively affected by imports to GDP. They employ multifactor modeling rather than the augmented CAPM model to avoid collinearity between exchange rate risk and the overall market risk. They also apply moving-window panel regression and orthogonalization of overall market risk in relation to currency risks. The research finds significant exposure for the aggregate German stock market. In a further study, Entorf *et al*. (2011) broaden their investigation to focus on currency exposure of 27 countries. The sample covers the years from 1991 to 2004, with 163 monthly observations. They extend the Adler and Dumas (1984) approach with an orthogonalized yield of the world equity index and the yield of the national currency per special drawing rights (SDR).

Another strand of literature related to our research lies on the evidence of the RMB exchange rate. Existing research documents mixed evidence of RMB exchange rate exposure on firms traded on the Shanghai and Shenzhen stock exchanges (see e.g. Wu *et al*., 2007; Luo and Jiang, 2007). In more recent research, Aggarwal *et al.* (2011) find that Chinese firms have relatively low exchange rate exposure than firms in other countries, while Miao *et al.* (2013) documents strong evidence of conditional and unconditional RMB exposure for 7 out of 16 Chinese industries at the firm level under the impact of the new Chinese exchange rate regime. Given the scant evidence in the empirical work, the interaction between China's capital market and RMB exchange rate exposure still remains an open question.

Methodologically, Friberg and Nydahl (1999) examine currency exposure using both the OLS and the generalized least squares (GLS) methods. Dominguez and Tesar (2001) adopt an augmented CAPM-type OLS regression, but the focus is on firm-level and industry-level exposure in France, Japan, the Netherlands and the UK. Several studies have employed the cointegration approach to explore exposure (e.g. Ratner, 1993; Ibrahim, 2000; Nieh and Lee, 2002; and Liu and Wan, 2012). Nonlinear methodologies have also been employed. For example, using a two-regime multivariate Markov-switching vector autoregression (MS-VAR) model, Ismail and Isa (2009) study the nonlinear interactions between stock prices and the exchange rate in Malaysia.

In more recent research, the GARCH models have received considerable attention in financial applications. The literature has shown that the GARCH (1, 1) specification is suitable for modeling the variance generating process of financial time series (Aabo, 2001; Muller and Verschoor, 2006; Muller and Verschoor, 2007; Jayasinghe and Tsui, 2008). Such GARCH models have also been applied to assess time-varying currency exposure (Dumas and Solnik, 1995; De Santis and Gerard, 1998; Francis *et al.*, 2008). Bollerslev (1990) extends the conventional GARCH to include a CCC factor, thus obtaining the full covariance matrix, rather than just the single variances as in the standard GARCH structure.

III. Econometrical Formulations

1. Generalized Autoregressive Conditional Heteroskedastic Estimation of the Augmented capital asset pricing model with Orthogonalized Return

Following Adler and Dumas (1984), the estimated country model can be expressed as:

$$R_i = \alpha_i^t + \gamma_i^t X_t + \varepsilon_i^t, \tag{1}$$

where R_i is the yield of the stock price index; α is the constant term; γ measures the total currency risk exposure; and X is the rate of return on the exchange rate. Depending on the particular situation, it could be the nominal trade-weighted exchange rates (FX), the yield of the national currency per SDR or the nominal bilateral exchange rates of the Chinese yuan, respectively, against the US dollar, the euro, the Japanese yen and the pound sterling. Equation (2) considers the effects of the world equity index by adding this index into the regression:

$$R_t^c = \alpha^c + \beta^c R_{w,t} + \gamma^c X_t + \varepsilon_i^c, \tag{2}$$

where $R_{w,t}$ stands for the yield of a world stock price index and γ is the Chinese stock market return sensitivity to exchange rate changes. Other variables are defined as before.

Given the possibility of correlation between the world equity index and exchange rate risk, we utilize the orthogonalized yield of a world equity index $R_{w,t}$. We first run an auxiliary regression in which the original $R_{w,t}$ is regressed on the national exchange rate:

$$R_w = \alpha^\circ + \gamma^\circ X_t + \varepsilon_i^\circ. \tag{3}$$

The residual of Equation (3) is then deployed as the orthogonalized yield ($R_{w,t}^\circ$). Combining Equations (2) and (3), the augmented CAPM with orthogonalized yield can be expressed as:

$$R_t' = \alpha' + \beta' R_{w,t}^\circ + \gamma' X_t + \varepsilon_t', \tag{4}$$

where $\alpha' = \alpha^c + \beta^c \alpha^\circ$; $\gamma' = \gamma^c + \beta^c \gamma^\circ$; $\beta' = \beta^c$ and $\varepsilon' = \varepsilon^c$.

Variance of the errors in financial time series is usually not constant over time. Hence, this study employs the GARCH (1, 1) model to adopt conditional variance as being dependent on previous own lags. The GARCH (1, 1) model is represented as:

$$R_t = \alpha + \beta R^{\circ}_{w,t} + \gamma X_t + \varepsilon_t$$

$$with\ \varepsilon_t = \mu_t * (h_t)^{1/2} \quad , \tag{5}$$

$$and\ h_t = \delta + \tau\varepsilon^2_{t-1} + \upsilon h_{t-1}$$

where h_t is the conditional variance of the residuals for period *t*; and $\delta, \tau\ and\ \upsilon$ are unknown parameters; ε^2_{t-1} is the squared residual of last month from the mean equation; h_{t-1} is the forecasted variance of last month; and μ_t is a white noise error term.

2. Constant Conditional Correlation-Generalized Autoregressive Conditional heteroskedastic Estimation of the Capital Asset Pricing Model

To take into account dependencies between time series in a multivariate setting, Bollerslev (1990) extended the standard GARCH model to include a constant conditional correlation factor (the CCC-GARCH model). Then, Engle and Kroner (1995) began modeling the entire covariance matrix in a dynamic way with a BEKK model. Although the BEKK model is more accurate, the large number of parameters makes it impractical for larger datasets; therefore, the more parsimonious scalar and diagonal versions of the BEKK model are desired.

The CCC model is defined as:

$$H_t = D_t R D_t = \left| e_{ij} \sqrt{h_{iit} h_{jjt}} \right| , \tag{6}$$

where $D_t = diag\left(h^{1/2}_{11t} ......h^{1/2}_{nnt}\right)$; h_t can be defined as any univariate GARCH model; $R = (e_{ij})$ is a symmetric positive definite matrix with $e_{ij} = 1, \forall i$, and *R* is the matrix containing the conditional correlation e_{ij}. Ht is positive definite if and only if all the N conditional variances are positive and R is positive definite. In our study, the original CCC model has a GARCH (1, 1) specification for each conditional variance in D_t:

$$h_{iit} = W_i + \alpha_i h_{ii,t-1} + \beta_i \varepsilon_{i,t-1}^2 \ , i = 1 \ldots N \tag{7}$$

3. Sample Selection and Data

The whole sample period spans January 2002 to December 2012, with 132 observations. The data are collected from the DataStream database. We use monthly returns of two Chinese stock market indexes: the MSCI China index from the Morgan Stanley and the Shanghai Composite Index supplied by the Shanghai stock exchange. The MSCI China index is based on large and mid-capitalization firms across China H shares, B shares, Red chips and P chips. The index has 141 constituent firms and covers approximately 85 percent of the China equity universe. The response of Chinese firms to exchange rate exposure captured by changes in this index has an intense international orientation, but its coverage is limited by the number of constituent firms. The Shanghai Composite Index is a good complementary fit with the MSCI China Index because of its wide coverage and domestic orientation. It comprises all the A shares and B shares that are traded at the Shanghai Stock Exchange. With 872 component companies, it is the most comprehensive domestic index of China equities.

We employ both the nominal trade-weighted exchange rate of the RMB and the yield of the national currency per SDR, which are gathered from JP Morgan and the International Monetary Fund’s International Financial Statistics, respectively. In addition, the research applies the nominal bilateral exchange rates of the RMB against the US dollar, the euro, the Japanese yen and the pound sterling.

IV. Empirical Results and Analysis

1. Generalized Autoregressive Conditional Heteroskedastic Estimation of Extended Capital Asset Pricing Model

Table 1 shows the estimation results of the currency exposure of the MSCI China index to the RMB exchange rate based on the orthogonalized CAPM in GARCH (1, 1) specification. The exchange rate variable used here involves a set of diverse exchange rates. Specifically, we consider the exposure of the MSCI China Index and the Shanghai Composite Index to six different exchange rates: the RMB trade-weighted exchange rate, and the RMB rates against the US dollar, the euro, the pound sterling, the yen and SDR.

From Table 1, it can be seen that the exposure coefficients in the extended CAPM model are highly significant, except for the RMB against the US dollar. Movements of the RMB against the euro, the pound and SDR have positive impacts on Chinese stock returns at the national level, while there are negative relations between the China stock price index and the RMB trade-weighted exchange rate and the RMB rate against the yen.

Table 2 reports the outcome with respect to currency exposure of the Shanghai Composite index to the six exchange rates. The table indicates that the trade-weighted exchange rate of the RMB has a negative association with the stock price, while the RMB rates against the euro, the pound and SDR show a positive trend to affect stock returns, respectively. Again, no significant results are found for the RMB rates against the US dollar and the yen.

<Please insert Table 1 about here>

<Please insert Table 2 about here>

2. Constant Conditional Correlation-Generalized Autoregressive Conditional Heteroskedastic Estimation

Table 3 reports estimates of the CAPM model obtained in the CCC-GARCH approach. The outcome is with respect to exposure of the MSCI China Index and the Shanghai Composite Index to the six exchange rates as in Tables 1 and 2. Panel A of the table reports the result with respect to the MSCI China Index. The A (1) row parameters indicate responses of the MSCI index to its own lag; that is, its own change in the previous period, t - 1. Parameters in A (2) capture the effects of exchange rates incurred by their own changes one period before. The outcome indicates that the MSCI index has significant own lagged effects, which are positive when the individual model includes effects of the exposure to the RMB/dollar, the RMB/GBP and the RMB/SDR exchange rate, respectively. As for the currency rates, A (2) indicates that the RMB against the US dollar and SDR would be affected by their own lagged changes.

Estimates in the B (1) row of Panel A depict the dynamic currency exposure, or the effects of exchange rate changes in the previous phase on the MSCI China index, and the B (2) estimates are the effects of stock price changes in the previous period on exchange rate volatility. The results for B (1) parameters show that, with the exception of the RMB trade-weighted exchange rate and the RMB/SDR rate, lagged RMB exchange rates have significantly positive effects on the MSCI China index. These results indicate the dynamic currency exposure in the CCC-GARCH setting. The results in the B (2) row suggest that, with the exception of the exchange rates of the RMB against the yen and SDR, changes in the MSCI China index in the previous period have significant and positive effects on the volatility of the currency rates.

We now move to Panel B of Table 3, which displays the results with respect to the Shanghai Composite Index. In Panel B, the estimated exposure of B (1) suggests that lagged changes of the RMB against the euro do not affect the returns on the Shanghai Composite Index; hence, there is no exposure for this currency pair. However, changes in the RMB rates against other currencies have significantly positive effects, especially the RMB rate against the yen, with a positive coefficient of 0.7923. For B (2) parameters, changes in the Shanghai Index in the previous phase ($t - 1$) would positively affect the changes of the RMB rates against the US dollar, the euro and the pound.

<Please insert Table 3 about here>

V. Conclusions

This paper investigates China’s exposure to currency risk at the national level since 2005 when the managed floating rate system was phased in and the nation consequently moved toward greater flexibility in the exchange rate regime. Focusing on the major international currencies, this research explores the sensitivity of China’s stock prices to fluctuations in the RMB exchange rate. An augmented CAPM model with orthogonalized yield is developed, which is estimated using the standard GARCH and the CCC-GARCH methods, respectively.

Empirical evidence obtained by this research indicates that, under the new exchange rate regime, the Chinese economy is exposed to significant currency risk. For the effective exchange rate that measures the overall change in the exchange value of RMB (i.e. the RMB trade-weighted exchange rate in our study), the major China stock indexes (i.e. the MSCI

China Index and the Shanghai Composite Index) have significantly negative exposure to the RMB exchange rate. This means that, on average, appreciation of the RMB could negatively affect stock prices, which plausibly associated with negative impacts of RMB appreciation on firm values and activity in China.

For the bilateral exchange rates of the RMB against the euro, the pound and SDR, in a static setting these indexes show significantly positive exposure, which implies that RMB depreciation (i.e. an increase in the RMB exchange rate) may stimulate firm activity and, hence, boost stock prices. In the case of RMB appreciation (reduction of the RMB rate), it will depress the stock prices and, hence, is a downside risk to the economy.

It is particularly worth noting that, in the static setting, the RMB/dollar exposure is insignificant. Whereas, movements of the RMB/yen rate are negatively associated with the MSCI China index, the parameter value is quite small. The RMB/yen exchange rate has no significant effects on the Shanghai Composite Index. However, in a dynamic setting, the China stock indexes are significantly exposed to all the bilateral exchange rates. This confirms the existence of dynamic currency exposure in China.

The new Chinese exchange rate regime features uneven flexibility for the RMB/dollar rate and the RMB against other currencies. In the early days of the new regime, while the RMB against other currencies was permitted to fluctuate in a band of plus and minus 1.5 percent around the central parity, the permissible band for the movements of the RMB/dollar rate is only 0.3 percent each way around the parity. With subsequent adjustments, it was only in July 2014 that the fluctuating band for the RMB/dollar rate was increased to 2 percent, while to the other currencies could fluctuate by 3 percent. This restrictive policy for the RMB/dollar movements, plus the Chinese Government's daily intervention in the RMB/dollar rate, means that the scope and magnitude of the RMB/dollar rate changes are limited, which may explain the insignificance of the RMB/dollar exposure in the static setting. However, gradually the dollar exposure becomes statistically significant. This implies, on the one hand, the Chinese cautious and gradual approach to increasing RMB/dollar exchange rate flexibility has some effects in that the regime has managed to keep the currency risk exposure to a moderate level, especially in the early stages of the new regime. However, on the other hand, with the growing, albeit gradual, liberalization of the RMB/dollar rate, currency risk exposure in China would become greater over time. In all, China has now entered into a new age of its macroeconomic management where managing currency risk exposure is becoming a growing challenge that China has to meet.

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Table 1. **Generalized Autoregressive Conditional Heteroskedastic Estimation of Exposure of MSCI China Index Using Orthogonalized CAPM**

		Trade-weighted exchange rate		RMB/USD		RMB/EURO		RMB/GBP		RMB/YEN		RMB/SDR	
		Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic
Mean equation	α	0.0097	2.7035	0.0089	2.4622	0.0080	2.2219	0.0063	1.3164	0.0093	2.5530	0.0101	2.8006
	β	0.9356	14.4574	0.9387	17.6278	0.8979	14.1321	0.9302	8.4448	0.9250	17.7850	0.9055	14.9952
	γ	−2.3674	−8.7974	−0.5449	−0.7587	1.1591	8.8128	1.2860	6.8883	−0.4623	−3.2611	2.1249	7.6059
Variance equation	δ	0.0002	1.2126	0.0002	1.1317	0.0002	1.1904	0.0003	1.0900	0.0002	1.1930	0.0002	1.1854
	τ	0.1154	1.4305	0.1109	1.4474	0.1223	1.3572	0.1189	1.1937	0.1185	1.4761	0.1215	1.3706
	ν	0.7695	5.6731	0.7805	6.0232	0.7510	4.7939	0.7880	5.1633	0.7696	5.9253	0.7562	4.9771
R^2			0.7238		0.7278		0.7249		0.5257		0.7241		0.7250
Adjusted R^2			0.7196		0.7236		0.7206		0.5184		0.7199		0.7207
SE of regression			0.0426		0.0423		0.0426		0.0560		0.0426		0.0426
Sum squared residual			0.2346		0.2312		0.2337		0.4042		0.2343		0.2336
Log likelihood			236.5718		236.9560		236.8372		201.7016		237.0036		236.8564
Durbin–Watson statistic			1.9002		1.8919		1.9384		2.0447		1.8474		1.9424
Mean dependent variable			0.0100		0.0100		0.0100		0.0082		0.0100		0.0100
SD dependent variable			0.0805		0.0805		0.0805		0.0807		0.0805		0.0805
Akaike info criterion			−3.4935		−3.4993		−3.4975		−2.9652		−3.5001		−3.4978
Schwarz criterion			−3.3625		−3.3683		−3.3665		−2.8341		−3.3690		−3.3668
Hannan–Quinn criter			−3.4403		−3.4461		−3.4443		−2.9119		−3.4468		−3.4446

Notes: The table reports results of MSCI China Index exposure to six different exchange rates: the RMB trade-weighted exchange rate, and the RMB rates against the USD, euro, pound, yen and SDR. RMB is the Chinese Yuan; USD is the United States Dollar; EURO is the Eurozone Currency; GBP is the British Pound Sterling; Yen is the Japanese Currency; SDR is the special drawing rights. MSCI stands for the MSCI (Morgan Stanley Capital International) China Index. Orthogonalized CAPM means the orthogonalized capital assets pricing model.

Table 2. Generalized Autoregressive Conditional Heteroskedastic Estimation of Exposure of Shanghai Composite Index Using Orthogonalized CAPM

		Trade-weighted exchange rate		RMB/USD		RMB/EURO		RMB/GBP		RMB/YEN		RMB/SDR	
		Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic	Coefficient	*Z*-statistic
Mean equation	α	−0.0041	−0.7035	−0.0048	−0.8257	−0.0055	−1.0572	−0.0041	−0.7462	−0.0038	−0.6343	−0.0034	−0.6102
	β	0.3449	4.1508	0.4924	5.8427	0.2907	3.4016	0.2992	3.7485	0.4563	5.3562	0.3250	4.0236
	γ	−1.7667	−3.7381	1.6059	1.1865	0.9456	5.1138	1.2221	5.5376	−0.2131	−0.9891	1.9006	4.6400
Variance equation	δ	0.0003	0.9871	0.0003	1.1299	0.0002	0.8580	0.0002	0.8844	0.0003	0.8579	0.0003	0.9269
	τ	0.1959	1.7243	0.1793	1.5969	0.3146	2.2028	0.2035	1.7611	0.1638	1.4966	0.2425	1.9190
	ν	0.7658	5.3865	0.7736	5.8732	0.6943	5.0969	0.7647	5.3708	0.7940	5.7881	0.7365	5.1706
R^2			0.2042		0.2482		0.2095		0.2619		0.2178		0.2209
Adjusted R^2			0.1919		0.2365		0.1972		0.2504		0.2056		0.2088
Standard error of regression			0.0768		0.0746		0.0765		0.0739		0.0761		0.0760
Sum squared residual			0.7604		0.7183		0.7553		0.7053		0.7474		0.7444
Log likelihood			163.6282		164.9485		166.8507		169.0175		161.8284		166.6535
Durbin–Watson stat			1.8995		1.8252		1.9506		1.8893		1.8778		1.9077
Mean dependent variable			0.0024		0.0024		0.0024		0.0024		0.0024		0.0024
SD dependent variable			0.0854		0.0854		0.0854		0.0854		0.0854		0.0854
Akaike info criterion			−2.3883		−2.4083		−2.4371		−2.4700		−2.3610		−2.4341
Schwarz criterion			−2.2573		−2.2773		−2.3061		−2.3389		−2.2300		−2.3031

Hannan–Quinn criter	−2.3351	−2.3551	−2.3839	−2.4167	−2.3078	−2.3809

Notes: The table reports results of Shanghai composite Index exposure to six different exchange rates: the RMB trade-weighted exchange rate, and the RMB rates against the USD, euro, pound, yen and SDR. RMB is the Chinese Yuan; USD is the United States Dollar; EURO is the Eurozone Currency; GBP is the British Pound Sterling; Yen is the Japanese Currency; SDR is the special drawing rights. Orthogonalized CAPM means the orthogonalized capital assets pricing model.

Table 3. Constant conditional correlation-generalized autoregressive conditional heteroskedastic (1, 1) Estimation of Exchange Rate Exposure Based on CAPM Model

	RMB & FX		RMB/USD		RMB/ EURO		RMB/ GBP		RMB/ YEN		RMB/ SDR	
	Coefficient	*t*-statistic	Coefficient	*t*-statistic	Coefficient	*t*-statistic	Coefficient	*t*-statistic	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Panel A Estimation of exposure of MSCI China Index												
A(1)	0.2650	1.8139	0.3072	35.4719	0.2785	1.9849	0.2592	2.1088	0.2839	1.9180	0.2874	2.2080
A(2)	0.0345	0.7221	0.9399	744.0196	0.0261	0.9495	0.0498	1.1381	0.0972	0.5889	−0.1430	−5.3918
B(1)	0.4620	1.0789	0.5550	55.4318	0.5132	2.2298	0.4985	2.7203	0.5657	3.2946	0.4134	1.6176
B(2)	0.8673	7.6099	0.3202	2700.8217	0.9365	20.6865	0.8156	7.5094	0.3389	0.5392	−0.0736	−0.2841
R(2,1)	−0.4033	−5.6361	−0.0728	−12.9813	0.4388	6.2308	0.4010	5.1327	−0.0957	−1.0791	0.3815	5.1714
Log-likelihood	548.3861		699.9135		453.4895		466.4221		452.1370		544.7883	
Panel B estimation of exposure of the Shanghai composite index												
A(1)	0.3334	1056.8303	−0.0497	−3.3312	0.2380	1.9413	0.2076	2.0955	0.1683	1.9475	0.3051	79.4082
A(2)	0.1735	4.1898	0.9172	11.5292	0.0333	1.1052	0.0373	0.9458	0.0681	0.3759	−0.1213	−1.6126
B(1)	0.1234	1635.5379	−0.1191	−1.2634	0.7329	6.1146	0.7551	7.3099	0.7923	9.1860	0.1410	130.1865
B(2)	0.1853	1.9546	0.2915	138.1629	0.9184	19.3399	0.8566	9.1493	0.1742	0.1812	0.1477	1.6297
R(2, 1)	−0.2758	−2.0480	0.1280	2.3024	0.3967	5.4599	0.4409	6.1020	−0.0517	−0.5285	0.3386	4.2450
Log-likelihood	535.7100		689.6946		441.2974		459.2874		442.5029		535.0808	

Notes: The table reports results of MSCI China Index and Shanghai composite Index exposure to six different exchange rates: the RMB trade-weighted exchange rate, and the RMB rates against the USD, euro, pound, yen and SDR. RMB is the Chinese Yuan; USD is the United States Dollar; EURO is the Eurozone Currency; GBP is the British Pound Sterling; Yen is the Japanese Currency; SDR is the special drawing rights. MSCI stands for the MSCI (Morgan Stanley Capital International) China Index. Orthogonalized CAPM means the orthogonalized capital assets pricing model.